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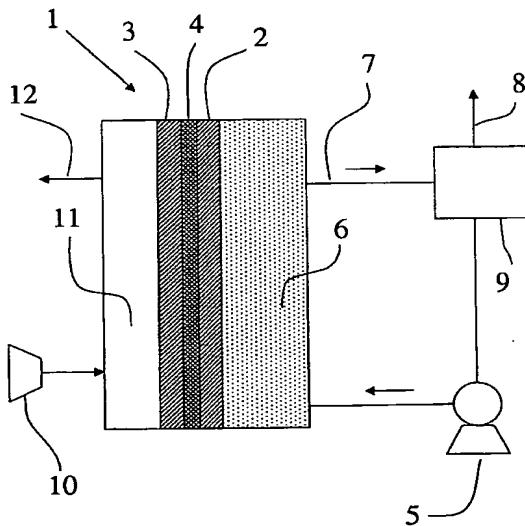
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(54) Title: FUEL CELL INCORPORATING A POLYMER ELECTROLYTE MEMBRANE GRAFTED BY IRRADIATION



(57) Abstract: Fuel cell comprising: (a) an anode; (b) a cathode; (c) a polymer electrolyte membrane placed between the anode and the cathode which comprises at least one polyolefin grafted with side chains containing proton conductive functional groups; wherein said fuel cell has: a value of cell resistance at 90 °C not higher than 0.30 Ω cm², preferably comprised between 0.2 Ω cm² and 0.25 Ω cm², more preferably comprised between 0.05 Ω cm² and 0.20 Ω cm²; a value of cell resistance at 20 °C differing from the value of cell resistance at 90 °C of an amount not higher than 90%, preferably not higher than 70%, more preferably not higher than 50%, with respect to the value of cell resistance at 90 °C. Preferably, said fuel cell is a direct methanol fuel cell (DMFC).

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B. FIELDS SEARCHED

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 242 123 B1 (ITO NAOKI ET AL) 5 June 2001 (2001-06-05) claims 1-31 ---	1-52
A	US 5 679 482 A (EHRENBERG SCOTT G ET AL) 21 October 1997 (1997-10-21) claims 1-25 ---	1-52
A	US 6 268 430 B1 (CHOI SUSAN KUHARCIK ET AL) 31 July 2001 (2001-07-31). claims 1-16 ---	1-52
A	US 4 287 032 A (PELLEGRI ALBERTO) 1 September 1981 (1981-09-01) claims 1-17 -----	1-52

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Patent document cited in search report		Publication date		Patent family member(s)		Publication date
US 6242123	B1	05-06-2001	JP DE GB	11111310 A 19844645 A1 2330836 A ,B		23-04-1999 01-04-1999 05-05-1999
US 5679482	A	21-10-1997	US AU BR CA CN DE DE EP JP WO	5468574 A 2644395 A 9507759 A 2190848 A1 1152929 A 69519855 D1 69519855 T2 0763070 A1 10503788 T 9532236 A1		21-11-1995 18-12-1995 23-09-1997 30-11-1995 25-06-1997 15-02-2001 02-08-2001 19-03-1997 07-04-1998 30-11-1995
US 6268430	B1	31-07-2001	US AU CA CN EP JP WO	6100324 A 3645599 A 2326845 A1 1297457 T 1082358 A1 2002511502 T 9952954 A1		08-08-2000 01-11-1999 21-10-1999 30-05-2001 14-03-2001 16-04-2002 21-10-1999
US 4287032	A	01-09-1981	IT DE FR GB JP JP JP	1122385 B 3028931 A1 2463200 A1 2060703 A ,B 1183970 C 56033489 A 58015549 B		23-04-1986 19-02-1981 20-02-1981 07-05-1981 27-12-1983 03-04-1981 26-03-1983